Subject Index

Abscisic acid family, 160
Absorption of carotenoids, optimal, 76
Acne, 279
Added beta-carotene, 28
Addition, peroxyl radical reaction with carotenoids by, 23
Adhesion molecule-1, 262
Adjuvant arthritis, rat, 270
Adjuvant cancer therapy, 255
AIDS, 257
Alcohol use, oral cancer and, 139
Alpha-carotene, supplementation of beta-carotene, lycopene, and, 244
Alpha-tocopherol, 183
Animal feeding studies, carotenoid, 54
Antenna function, 33
Anthropometry, nutritional status assessed by, 104
Anti-inflammatory activity of beta-carotene, 270
Antioxidant, beta-carotene as, 148
Antioxidant capacity, *in vitro* assessment of, 48
Antioxidant reactions of carotenoids, 20
Antioxidants
  chemopreventive role for, 145
  lipid-phase, 177
  soybean lipoxygenase and, 196
Anti-stress effect of beta-carotene, 281
Anti-tumor effects, beta-carotene-mediated, 266
Apocarotenoids, 162
Aspirin, cardiovascular disease and, 151
Associations of carotenoids, 164
Atherosclerosis, 204
Autoxidation reactions, 20

Basel Prospective Study, 150
Beta-apo-13-carotenone, 172
Beta-apo-14′-carotenal, 172
Beta-apo-carotenoids, 170
Beta-carotene
  added, 28
  anti-inflammatory activity of, 270
  anti-stress effect of, 281
  bioavailability of, in ferret, 229
  cardiovascular disease and, 148
  cervical dysplasia trials and, 253
  cis-peak for change of, 3
  distribution of, in lipoprotein fractions of ferret serum, 232
  gene expression activated by, 61
  HIV infection and, 277
  human absorption of, 76
  13-hydroperoxide inhibition by, 195
  immune functions and, 262
  immunostimulation by, 255
  incorporated, 28
  labeled, appearance and disappearance of, 93
  LDL lipoprotein and, 200
  LDL system containing, 57
  leukoplakia and, 143
  lung cancer risk and, 69
  metabolism of, by microsomal enzymes, 287
  mortality risk and, 120
  photosensitivity and, 128
  preruminant calf and, 226
  reactions of, with peroxyl radicals, 23
  smoking and, 120
  supplementation of, in rats, 220
  supplementation of alpha-carotene, lycopene, and, 244
  10T1/2 cells and, 181
  tumor-sensitized splenic T lymphocytes and, 264
  unique protection by, 115
  uptake, metabolism, and distribution of, *in vitro*, 284
^{13}C-Beta-carotene, 86
9-*cis* Beta-carotene, 216
  increase of, in circulating blood cells, 239
  presence of, in human serum and tissue, 14
mono-*cis* Beta-carotene, 229
Beta-carotene isomers, 223
Betatene, 57
Bioactivities of carotenoids, 164
Bioavailabilty
  beta-carotene
    in ferret, 229
    in human adults, 238
  carotene, and carotene status, 105
  definition of, 96
Bioconversion, definition of, 97
Biological oxidation, 287
Black populations of Los Angeles, 73
Bleaching of carotene, 192
Blood plasma, carotenoids in, 82
Bombyx mori, carotenoid-binding protein from, 210
Burn injury, 274

Cancer (*see specific cancers*)
  serum beta-carotene levels and, 62
Cancer chemoprevention, 177
Cancers
  risk of, 112
  second, 144
Canthaxanthin, 181
Capsorubin, 12
Carcinogenesis, cancer prevention and, 140
Cardiovascular disease
  beta-carotene and, 148
  beta-carotene supplementation and, 62
CARET Study, 151
Carotene
  bleaching of, 192
  palm oil, 54
Carotene diet
  low, 106
    association of skin lesions with, 279
Carotene status, 105
Carotene uptake, effects of nutritional status on, 96
Carotenoid analogs, 162
Carotenoid animal feeding studies, 54
Carotenoid-binding protein, purification of, 210
Carotenoid food composition values, 68
Carotenoid intakes, methodologies for assessing, 69
Carotenoid levels, lung cancer and, 124
Carotenoid therapy, nonresponders to, 130
Carotenoids
  absorption of, 76
  antioxidant reactions of, 20
  associations of, 164
  bioactivities of, 164
  biological functions of, 163
  burn injury and, 274
  cancer prevention by, 177
  cis-trans isomerization of, 10
  cooxidation of, 192
  dietary, biological functions of, 61
  erythropoietic protoporphyria and, 127
  human health and, 44
  LDL system containing, 55
  lutein and, 207
  lymph and, 80
  molecular actions of, 156
  mucosal cell uptake of, 79
  oral cancer and, 139
  photochemistry of, 32
  photosensitivity diseases and, 127
  physical and chemical properties of, 1
  portal circulation and, 80
  provitamin A, 110
  provitamin A activities of, 213
  soybean flour and, 192
  storage of, 83
  toxicity of, 133
  zeaxanthin and, 207
Carotenoporphyrin, 35
Carotenopyropheophorbide dyads, 36
Carrot oil, photosensitivity disease and, 128
Carrots
  beta-carotene drink and, 291
  Guatemalan children's diet supplemented with, 105
Cataracts, 62
Caucasian diet history, 73
CD4/CD8 ratio, 277
Cellular retinol-binding protein type II, 81
Cervical dysplasia trials in Australia, 253
Chemical oxidation, 287
Chemoprevention trials, beta-carotene and, 117
Chicks, zeaxanthin studies on, 213
Chinese Antioxidant Vitamin Cocktail Study, 151
Chinese diet history, 73
Cholesterol, 232
Chylomicron remnant
  ^{13}C-beta-carotene and, 94
  formation of, 83
cis-peak, 3
Clinical trials, 205
Congenital porphyria, 130
Connexin43, 178
Connexins, aggregation of, 184
Cooxidation, 192
Coronary artery disease, beta-carotene protection against, 204
Corynebacterium poinsettiae, 127
Cross-sectional format, 105

Deaths from all causes, 124
Depletion and repletion format, 106
Diet, oral cancer and, 141
Diet history, 72
Dietary and non-dietary factors affecting absorption of carotenoids, 78
Digestion of the food matrix, 76
7,12-Dimethylbenz[a]-anthracene, 259
4,4'Dimethoxy-beta-carotene, 162
Dioleylphosphatidyl choline liposome system, 52
Dioxygenase activity, 220
1,1-Diphenyl-2-picrylhydrazyl radicals, 48
DNA strand breaks, 12
Drink, beta-carotene, 290
Dunaliella bardawil, 238
Dunaliella salina, extract from, 14

Endoperoxide, 28
Energy gap law, 6
Enzymes, 157
Epidemiologic studies, use of carotenoid food composition values in, 68
Epithelial protection, 224
Erythroplakia, 142
Erythropoietic protoporphyria, carotenoids in, 127
Esophageal cancer, 117
Excentric cleavage, 167

Fat, calories from, 114
Feedback regulation, 106
Ferret
  beta-apo-carotenals and, 173
  beta-carotene supplementation in, 232
Fibroblasts, 284
Field cancerization, 139
Filipino diet history, 73
Finland, chemoprevention trials in, 117
Finnish Alpha-Tocopherol/Beta-Carotene Study, 151
Food matrix, digestion of, 76
Free radicals, cancer induction and, 259
Fruit and vegetable intake, serum carotenoid levels in response to, 242
Functions, biological, of carotenoids, 163

Gamma radiolysis, 246
Gap junctions, 178
Gas chromotography-combustion-gas isotope ratio mass spectrometry, 87–88
Gastric cancer, 117
Genotoxic agents, 255
Green, dark, vegetable consumption, 111
Growth failure, detection of, 104
Gunther's disease, 130

Hawaiian diet history, 73
Health Professionals Follow-Up Study, 149
Hispanic populations of Los Angeles, 72–73
HIV infection, beta-carotene in, 64, 277
Honolulu Heart Program, 110
Human health, carotenoids and, 44
Humans, 250
  beta-carotene metabolism in, 86
13-Hydroperoxide, beta-carotene inhibition of, 195

Immune activity, carotenoid enhancement of, 133
Immune functions, beta-carotene supplementation and, 63
Immune response
  beta-carotene and, 262
    in HIV, 277
Immune status, burn injury and, 275
In vitro
  antioxidant effectiveness of beta-carotene, 28
  beta-carotene uptake, metabolism, and distribution, 284
In vitro assessment of antioxidant capacity, 48
In vivo, carotenoid action, 192
Incorporated beta-carotene, 28
Inhibition, 193, 283
Intercellular communication, 179
Interleukin-1, macrophages from beta-carotene-treated arthritic animals and, 273
Interleukin-8, burn injury and, 276
Intestinal perfusion, 173
Invasive procedure, risk associated with, 93
Isomers, 158
cis-trans Isomers of carotenoids, 13

Japanese diet history, 73

Kupio Ischemic Heart Disease Study, 150

Leukoplakia, 142
Linxian, China, chemoprevention trials in, 117
Lipid micelles, formation of, 79
Lipid peroxidation, 181
Lipid Research Clinic Coronary Primary Prevention Trial, 150
Lipid-phase antioxidants, 177
Lipoproteins, human transport of carotenoids via, 82
Lipoxygenase, soybean, 192
Liquid chromatography methods, evaluation of, 115
Liver, beta-carotene concentration in, 55
Low-density lipoprotein
  beta-carotene in, 57
  cardiovascular disease and, 151
  protection of, from oxidative modification, 200
Lung cancer
  high incidence rates of, in Finland, 117
  odds ratios for, 70
  provitamin A carotenoids and, 110
Lutein
  oxy and sulfur radical scavenging activity of, 246

  serum reference values for, 207
Lycopene
  metabolism of, by microsomal enzymes, 287
  presence of, in human serum and tissue, 14
  supplementation of beta-carotene, alpha-carotene, and, 244

Maldigestion of lipids, protein, and disaccharides, 97
Malnutrition, protein-energy, 97
Markers of fruit and vegetable intake, 243
Massachusetts Elderly Cohort Study, 150
Mastalgia treatment, 256
Maximum tolerated dose, 250
Membranes, 284
Metabolism
  9-*cis* and 13-*cis* beta-carotene, 225
  beta-carotene, 86
  structure of beta-carotene and, 156
Methodologies for assessing carotenoid intakes, 69
Microsomes, 287
Mobility in human low-density lipoproteins, oxidation and, 57
Molecular actions, 156
Mortality risk, beta-carotene intake, smoking, and, 120
Mucosal cells, uptake of carotenoids by, 79
Myocardial infarctions, 149

N-myc, 267
National Health and Nutrition Examination Study I, 114
National Health and Nutrition Examination Study II, diet histories in, 73
National Health Interview Survey, 1987, 114
Natural killer cells, 262
Neoplastic transformation, 177
Nonmelanoma skin cancer, 120
Nonresponders, 82
Nurses' Health Study, 149

Oral cavity cancer, 139
Oxidized low-density lipoprotein, 200

Palm oil carotene, 54
Parinaric acid assay, 49
Peroxyl radicals, reactions of beta-carotene with, 23
Pharmacokinetic approaches, 94
Phorbol 12-myristate 13-acetate, 259
Photooxidation of beta-carotene, 26
Photoprotection, carotenoid, 34
Photosensitivity diseases
  beta-carotene supplementation and, 63
  carotenoid use in, 127
Photosensitization, 128
Photosynthesis, carotenoids in, 33
Phycoerythrin acid assay, 49
Physical and chemical properties of carotenoids, 1
Physical quenching, definition of, 26
Physicians' Health Study, 151
  coronary artery disease in, 204
Plasma retinol, ^{13}C-beta-carotene and, 88
Polarizability, solvent, 2
Polyene polyketones, 12
Polymorphic light eruption, 131
Porphyrins, 128
Preformed vitamin A, 103
Premalignant lesions, 142
Preruminant calf, beta-carotene transported in, 226
Product-forming reactions, relationship of antioxidant effects to, 25
Protective function of carotenoid pigments, 132
Protein-energy malnutrition, 97
Provitamin A activity, 214

Quenching, carotenoids' protective effects and, 132
Quenching of tetrapyrrole fluorescence, 43
Questionnaires, diet history, 72

Radical intermediate, 22
Radioactivity, risk associated with, 93
Rat
  adjuvant arthritis in, 270
  vitamin A-deficient
    beta-carotene supplements in, 216
    provitamin A activity in, 213
all-*trans* Retinoic acid, solid tumors and, 250
9-*cis* Retinoic acid, 9-*cis* beta-carotene and, 17
Retinoids
  bioconversion of carotenes to, 101
  chemoprevention and, 177
Retinol
  4-hydroxylation of, 287
  cellular levels of, 285
Retinol levels, low, Egyptian children with, 106
Retinyl ester appearance, 104
Rhodopseudomonas spheroides, 127

Sarcina lutea, 127
Sensitizer, 10

Serum beta-carotene levels, lung cancer and, 110
Serum carotenoids, controlled diets and, 241
Serum, human, carotenoids in, 207
Silkworm, carotenoid-binding protein from, 210
Singlet oxygen
  oxidation of beta-carotene by, 26
  physical quenching of, 12
Singlet-singlet energy transfer, 34
Skin Cancer Prevention Study, 120
Skin lesions, low-carotene diet in premenopausal women and, 279
Skin tumors, combination of beta-carotene and vitamin E and, 259
Small cell lung cancer, 267
Smokers
  beta-carotene drink and, 292
  coronary heart disease risk in, 204
Solar urticaria, 131
Soybean flour, cooxidation of carotenoids by, 192
Spheroidene
  absorption spectrum of, 2
  HPLC chromatogram of, 4
Stable isotope methodology, beta-carotene metabolism and, 86
Stable isotopes, labelling of carotene molecule with, 101
Stomach cancer, beta-carotene intake and, 112
Storage of carotenoids, 83
Stress-related hormones, 281
Studies (*see name of study*)
SU.VI.M.AX Trial, 151
Sulfur radicals, 247
Sunlight, 128
Supplementation, beta-carotene, alpha-carotene, and lycopene, 244
Surveys (*see name of survey*)

T lymphocytes, 265
Tetrapyrrole fluorescence, carotenoid quenching of, 43
Third World countries, hypovitaminosis A in, 107
Tobacco use, oral cancer and, 139
Tolerance test, beta-carotene, 99
Toxicity, all-*trans* retinoic acid and, 250
Toxicity of carotenoids, lack of, 133
Tracheal mucosa, 217
Transport of carotenoids, 80
Trials (*see name of trial*)
Triplet states, 5
Triplet-triplet energy transfer, 34
Trisporic acid, formation of, 160
Trisporic acid family, 159
Trolox
  addition of, to a phycoerythrin system, 49
  peroxy radical scavenging of, 249
Tumor necrosis factor-alpha, 262
Tumor visualization, 46
Tumors, advanced solid, phase I study of, 250

U.S.-Finland Lung Cancer Prevention Trial, 117

Vegetable and fruit intake, cancer risk and, 112
Violaxanthin, 161
Vitamin A
  absorption of, 76
  distribution of, in lipoprotein fractions of ferret serum, 232
  formation of, 159
  helper T lymphocyte levels and, 65
  low/high intake of, 220
  preformed, 103
  skin lesions and, 279
Vitamin A family, 157
Vitamin A status, carotene bioconversion and, 106
Vitamin A stores, 218
Vitamin A-free diet, Egyptian adult volunteers assigned to, 106
Vitamin C
  cancer etiology and, 117
  protection of LDL by, 203
Vitamin E
  cardiovascular disease and, 151
  LDL system containing, 55
  protection of LDL by, 202

Western Electric Company employees, 110
Women's Health Study, 151

Xenon arc light, tolerance to, 130

Yellow-orange, dark, vegetable consumption, 111
Yellowing of skin, beta-carotene supplementation causing, 201

Zeaxanthin, serum reference values for, 207

Index of Contributors

Adamson, P. C., 250–252
Akporiaye, E. T., 264–266

Bachmann, H., 270–273
Baghurst, P., 253–254
Bender, J., 264–266
Bendich, A., 61–67
Bertram, J. S., 177–191
Bianchi-Santamaria, A., 255–258
Bierer, T. L., 76–85, 226–228
Biesalski, H. K., 216–219, 223–225
Blanco, M. C., 232–237
Bowen, P. E., 207–209, 241–243
Braune, L. M., 262–263
Brenna, J. T., 86–95
Bulux, J., 96–109
Burri, B. J., 279–280

Canfield, L. M., ix, 192–199, 264–266
Canfield, W. K., 86–95
Carughi, A., 244–245
Chopra, M., 246–249
Clifford, A. J., 279–280
Coffey, J. W., 270–273
Coodley, G. O., 277–278

Dixon, Z. R., 279–280
Doi, T., 290–292
Dunkel, V. C., 284–286

Erdman, J. W., Jr., 76–85, 226–228, 229–231, 279–280

Fairley, C., 253–254
Folk, C., 277–278
Fong, A. K. H., 279–280
Fox, J. G., 232–237
Frank, H. A., 1–9

Galligan, L. J., 267–269
Garewal, H. S., 139–147, 262–263
Garg, V., 241–243
Gaziano, J. M., 148–155
Gerber, L. E., 267–269
Goodman, K. J., 86–95
Greenberg, E. R., 120–126
Gugger, E. T., 76–85
Gust, D., 32–47

Hankin, J. H., 68–75
Hasegawa, T., 281–283
Hayashi, K., 238–240
Hennekens, C. H., 148–155
Hooper, F., 244–245

Irwig, L., 253–254

Jackson, C. L., 267–269
Jori, G., 32–47
Jouni, Z. E., 210–212

Khilnani, R., 274–276
Kolonel, L. N., 68–75
Kormann, A. W., 213–215
Kornhauser, A., 259–261, 284–286
Kovach, J. S., 250–252
Kretsch, M. J., 279–280
Krinsky, N. I., 167–176

Lambert, L. A., 259–261
Lavu, S., 259–261
Le Marchand, L., 68–75
Liebler, D. C., 20–31
Lopez-Miranda, J., 232–237
Loveless, M. O., 277–278
Lown, D. A., 274–276

Mackerras, D., 253–254
Manago, M., 238–240
Mares-Perlman, J. A., 207–209
Marmor, B., 86–95
Masaki, K., 290–292
Mathews-Roth, M. M., 127–138
Matusik, J. E., 284–286
Merchen, N. R., 226–228
Mino, M., 238–240
Moore, A. L., 32–47
Moore, T. A., 32–47
Morinobu, T., 238–240
Murata, T., 238–240

Nagao, A., 287–289
Nagata, Y., 290–292
Nelson, D. R., 226–228
Nelson, H. D., 277–278
Nemzek, R., 270–273

Olson, J. A., 156–166, 287–289
Ordovas, J. M., 232–237

Packer, L., 48–60
Parker, R. S., 86–95, 274–276
Parthasarathy, S., 200–206
Peck, K. M., 229–231

Petersen, A., 264–266
Pierce, P., 264–266
Pitot, H. C., IV, 250–252
Prabhala, R. H., 262–263

Reaven, P. D., 200–206
Reddi, E., 32–47
Ribaya-Mercado, J. D., 232–237
Riss, G., 223–225
Rock, C. L., 274–276
Rodriguez, J. L., 274–276
Rubin, J., 250–252
Russell, R. M., 167–176, 232–237

Santamaria, L., 255–258
Schreiner, R. S., 241–243
Schreurs, W. H. P., 220–222
Schutt, A. J., 250–252
Sies, H., 10–19
Simpson, J., 253–254
Solomons, N. W., 96–109
Spielman, A. B., 86–95
Stacewicz-Sapuntzakis, M., 207–209, 241–243
Stahl, W., 10–19
Swanson, J. E., 86–95

Takenaka, H., 238–240
Tamai, H., 238–240
Tang, G., 167–176
Thurnham, D. I., 246–249

Ulman, E. A., 229–231

Valenzuela, J. G., 192–199, 264–266
Van Den Berg, H., 220–222
Van Schaik, F., 220–222
Van Vliet, T., 220–222
Viereck, S. M., 86–95

Wamer, W. G., 259–261, 284–286
Wang, X.-D., 167–176
Watson, R. R., 262–263
Wei, R. R., 259–261, 284–286
Weisberg, E., 253–254
Weiser, H., 213–215, 216–219, 223–225
Wells, M., 210–212
White, W. S., 229–231
Wilkins, L. R., 68–75
Willson, R. L., 246–249
Witztum, J. L., 200–206

Yelton, L., 241–243
Yoshioka, Y., 290–292
Yuge, K., 290–292

Ziegler, R. G., 110–119